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Preparation of the learning content for semantic e-learning environment

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Abstract

Development of semantic Web has significantly influenced changes in Web based e-learning systems. Semantic e-learning environment is setting new requirements for storing learning objects. In order to enable interpretation of learning objects by applications and computers as well as interoperability of machines and applications, it is necessary to store not only the learning content but also its description (metadata). This is achieved thanks to homogenous semantic annotation in accordance with predefined metadata schemes.

Important aspect is integration of the learning content into previously mentioned metadata schemes.

This article presents certain facts that need to be considered in the process of generating consistent metadata that will be useful for manipulation of learning objects.

Keywords: Semantic e-learning environment; reusability learning object; metadata; ontology.

1. Introduction

E-learning already became a component part of education a long time ago, like a support to traditional educational process, like support to distance learning or in blended learning.

A lot of e-learning systems is available today, but most of them have very limited possibilities because they base their work on statistics display of educational content. Implementation of Bologna process in higher education and new paradigm of educational process is oriented to a student (Learner – centered paradigm), but these systems are poor in guiding, motivation and individualization of student learning system according to his affinities, knowledge and skills.

According to actual tendencies it is necessary to personalize learning process implementing adaptive and intelligent functionalities and also create model of repository for semantic e-learning environment.

Semantic environment means that information content except people, can also process computers. Necessary prerequisite for that is total separation of presentation content as well as semantic selection of content.

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In order to educational contents relating on different sections of knowledge, to be used again in learning process and teaching and to be available it is necessary to transform in learning objects and therefore pursue referred standard and have common infrastructure.

2. Learning object

According to IEEE Learning object metadata (LOM) standard: „Learning object is any entity, digital or no-digital, that can be used, reused again or invite during the learning process“ (IEEE – LOM, 2002).

Learning object (LO) is main unit of electronic educational content that gets created with maximization different use cases and simplier distribution and reusage, idea similar to object-oriented paradigm (Coad at al., 2003). The most important aspect of creation LO for reuse is consistent description of semantic of its content through metadata. Metadata, beside its usage for description of resources, are also used for their administration and structuring (Leiner at al, 1998). Description of objects is more effective if metadata contain and their semantic meaning beside of their syntactic description.

Metadata can also include next information about LO:

- reference to location where LO is saved,
- criteria by which the object is different than others,
- information that enables administration of object or
- that enable us to identify all parts of object.

If we want to use LO, not only in e-Learning system what is its main purpose but for sharing information between different repositories, some aspects of LO must be standardized (Lopez at al., 2005.).
There are more standards for LOs description. Some of them are :

- IEEE LOM,
- Dublin Core,
- IMS,
- SCORM,
- ...

LO is main unit of educational content and its meaning can be integrated into e-learning environment. For that it is necessary that LO has these features [Daniel R at al., 2003]:

1. reusability,
2. accessibility,
3. interoperability,
4. portable and
5. durability.

Advantages of objects learning in e-Learning environment:

1. Flexibility- same resource can be used in different context
2. Administration of content – it is possible to administrate resources in a simple way, because they are described with metadata,
3. adaptivity – it enables selection and usage of resources by the needs of context ,
4. economy – thanks to possibilities of reusage,
5. open source- that enables compatibility with different platforms.

3. Standards for description of learning objects

Learning objects use specialized and education oriented set of metadata. In LOs domain it is necessary to standardized: metadata which describes LO, LO content models, form of exchange LO content (LO Content Packaging) between different repositories and/or e-Learning system.
IEEE LOM standard presents first accredit standard in education technology field.

This standard defines set of elements (metadata) that describes LO. LOM Schema expands Dublin Core Schema in elements and attributes adjusted to specific needs of students and teachers who search the Web for relevant educational content.

LOM standard groups elements that describe LO in nine categories according to their purpose:

1. *general category,*
2. *lifecycle category,*
3. *meta-metadata category,*
4. *technical category,*
5. *educational category,*
6. *rights category,*
7. *relation category,*
8. *annotation category,*
9. *classification category.*

For one part of LOM Schema's elements, standard provides allocation of values in form of free text, while other elements require usage of values from set of values defined by standard (vocabulary) for that element.

The main idea of LOM standard was to find shared base for needs of applications from different fields of computer-support learning and to create a standard that will satisfy identified set of needs. All categories of metadata are not obligated, it is left to users possibility to expand base schema's according to specific needs. LOM is imagined as a shared starting base for description of learning content with metadata that will enable exchange and usage of that content.

For standardization of LO content models we use ontology's. There is a various number of definitions of ontology's, but most cited is definition of Tom Gruber (1993): " Ontology is formal specification of shared conceptualization of some domain " or shorter " Ontology is formal specification of conceptualization". When we create ontology it is necessary to define next things:

- classes in domain of inters,
- relations that can exist between those classes,
- attributes of those classes,
- restrictions of attributes which allows us to check consistency of set solutions, and also to improve research and reach of new knowledge.

extensible Markup Language-a (XML) has aroused as a standard for ontological representation of knowledge, data exchange and interoperability.

In semantic e-Learning environment we use two types of ontology's:

- Ontology for personalization of learning based on preferences and learning styles of students
- Ontology of physical structure learning objects, which enables usage and understanding of objects in different systems of learning.

In domain of education it is impossible to define unique otology of physical structure of objects for all areas of knowledge. For different fields of knowledge we define local ontology's. In order to make local ontologies comparable to each other they are built from a global ontology. Global ontology (Fig. 1.) for University semantic environment can be shown using hierarchy tree (Bevanda V., 2005).

The ontology for University community consists of six related ontology's: organization ontology, person ontology, research ontology, learning resources ontology, event ontology and news ontology.

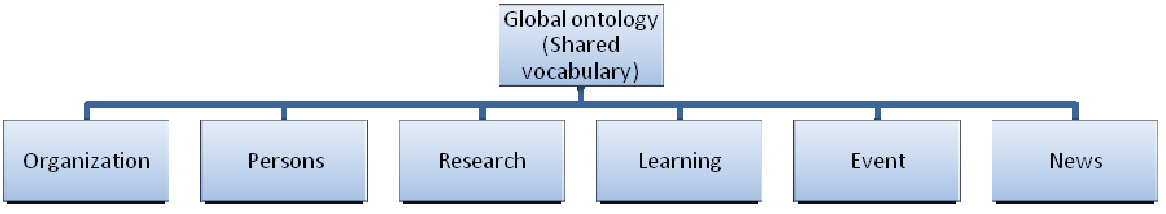

Fig. 1: Ontology architecture for University's semantic enviroment

There are a number of proven technical approaches to solving the problem of integrating local ontologies that have been developed separately for overlapping domains. Some of the current possibilities are:

- enhancing two ontology's to produce a single, global ontology. This strategy has proven useful in many RDF based solutions.
- Point-to-point mapping. Two ontology's are shown side-by-side. A user explicitly maps concepts and relations from one side to the other. These connections are translated into logical constraints on the ontology's. A number of vendors provide tools to support this kind of mapping.
- Merging ontology's into a single master ontology.

Computers can interpret information contents presented by usage of ontology's. Ontologies represent knowledge and formally define concepts from different fields and relations between them. Using represented knowledge in this way it is possible to bring conclusions.

4. Learning Object Repository

LO and his repository are elements complementary between themselves. They are stored in repository and in given way organized learning objects. Learning objects have to be adequately marked so they could be identified inside repository.

Repository and learning objects stored in it have to follow certain standards.

Learning objects are described in metadata file that gets packed together with the object content and puts on server.

Repository standardization will insure structurally searching and objects exchange between different repositories , what expands search area and increase possibilities for finding matching object.

Learning objects stored in repositories will access people via interactive interface and software agents via interface will put up inquiries.

There are two types of LO repositories (Lopez C at al, 2005):

- repository that stores object content for learning and his description inside the same system, possible and on same server and
- repository that stores metadata and reference on physical location LO content.

LO repository will enable objects usage and their modification in the case of need, what is a benefit to students and teachers but also serves for automatic data exchange between systems.

5. Conclusion

Nowadays E-learning needs to provide quality educational content with help of semantic environment, where semantic information is adequately defined and in that way is enabled computers and people cooperation in process of knowledge sharing. Systems and application on this way defined information can used adequately, integrate them and reused, and all with a view of delivering student for him relevant content.

Semantic e-learning environment can use LO repository on local and global level, where ontology give learning objects their pedagogic meaning and emphasize personalization and adaptively of learning content.

Repositories that contain learning objects introduced with ontology usage are simpler to search and search results are more precise, what simplify finding adequate LO to student for learning and teacher for creating the course. Also there is a possibility that applications on automatic way use and integrate in learning object courses introduced with ontology.

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